ISSN (print) 0093-4666 © 2011. Mycotaxon, Ltd. ISSN (online) 2154-8889

MYCOTAXON

Volume 115, pp. 469–480 *January–March 2011*

DOI: 10.5248/115.469

Additional species of *Graphis* from Maharashtra, India

Gayatri Chitale, Urmila Makhija & Bharati Sharma*

Agharkar Research Institute, G.G. Agarkar Road, Pune - 411004, India
* Correspondence to: *bharatiomsharma@gmail.com*

Abstract—Our recent investigations of the lichen flora of Maharashtra have brought to light several new taxa in the family *Graphidaceae*. Nine species of *Graphis* with muriform ascospores are recognized of which two, *G. maharashtrana* and *G. elevativerrucosa,* are described as new to science. One new combination, *G. panhalensis* is proposed. Two species, *G. galactoderma* and *G. parilis,* are recorded from India for the first time, and *G. platycarpa* and *G. subducta* are reported for the first time from Maharashtra. *Graphis* sp. 1 is clearly distinguished from the other species, but is not formally described as new to science as the material is scanty. A revised key to all species of *Graphis* from Maharashtra is provided.

Keywords—taxonomy, ascomycetes, lichenized fungi

Introduction

The Western Ghats of India form a practically unbroken mountain chain dominating the western coast of the Indian peninsula for almost 1600 km. They extend from the mouth of the river Tapti in Gujarat to Kanyakumari, the tip of South India in Tamil Nadu. The region consists of hills spreading north–south along the coast traversing the states of Gujarat, Maharashtra, Goa, Karnataka, Tamil Nadu, and Kerala and enjoys a tropical climate. The Western Ghats, which are exceptionally biodiverse and occupy a special position in the Indian subcontinent because of the interesting flora, are one of the richest lichen sites of India. Thus far, 800 lichen species, including 219 (i.e. 27%) potential endemics, have been recorded from this region (Singh et al. 2004).

Although a large number of lichens have been recorded from the Western Ghats of South India, Maharashtra has long been among the least explored places. During our recent investigations of the lichen flora of Maharashtra, we recorded several species in the family *Graphidaceae,* including ten species of *Graphis* with transversely septate ascospores and two species of *Dyplolabia* (Makhija et al. 2005a), ten species of *Hemithecium* (Makhija et al. 2005b; Chitale et al. 2009), three species of *Pallidogramme* (Chitale et al. 2009), and eleven species of *Diorygma* (Sharma & Makhija 2009, Makhija et al. 2009).

Graphis Adans. (sensu Staiger 2002), a widespread tropical lichen genus with about 300 species known worldwide (Lücking 2009, Lücking et al. 2009), is characterized by a thallus crustose that is corticolous and epi- or endophloeodal (rarely saxicolous or foliicolous); a green algal photobiont (*Trentepohlia*); lirellate ascomata that are usually elongate, simple or variously branched (rarely short oryzaeform), and immersed in the thallus or emergent and sessile; a totally or partially but distinctly carbonized exciple with well developed, convergent, and entire or crenate-sulcate labia; simple paraphyses that are not thickened at apices; asci clavate to subcylindrical, (1–)2–4–8-spored, unitunicate, and ascospores colourless, 3–many trans-septate, or muriform, locules lentiform, I+ blue violet.

Graphis is represented by 85 species from the Indian subcontinent (Adawadkar & Makhija 2004, 2006, 2007; Makhija & Adawadkar 2005a,b; Makhija et al. 2005a, Jagadeesh Ram et al. 2007) and by ten species with trans-septate ascospores from Maharashtra (Makhija et al. 2005a). In the present paper we report the occurrence of nine *Graphis* species with muriform ascospores from Maharashtra. Two species (*G. maharashtrana, G. elevativerrucosa*) are described as new to science. *Graphis galactoderma* and *G. parilis* are reported for the first time from India and *G. platycarpa* and *G. subducta* for the first time from Maharashtra. *Graphis panhalensis* is proposed as a new combination. *Graphis* sp. 1, which is clearly distinct from the other species, is not formally described as new to science as the material is scanty. A key is provided to all species of *Graphis* (both with trans-septate and with muriform ascospores) now known from Maharashtra,.

Materials & methods

Chemical constituents were identified by thin-layer chromatography using methods standardized for lichen products (Culberson & Kristinsson 1970, Culberson 1972, White & James 1985) with the solvent systems benzene-dioxane-acetic acid (180:45:5), hexane-ethyl ether-formic acid (130:80:20) and toluene-ethyl acetate-formic acid (139:83:8). All specimens examined are deposited in Ajrekar Mycological Herbarium (AMH).

Taxonomy

Graphis elevativerrucosa Chitale, Makhija & B.O. Sharma, **sp. nov.** Fig. 8

MycoBank MB 519296

Similis Graphis bilabiata*, sed lirellis longioribus, immerses in verrucosus et acid continens differt*.

Holotypus—India. Maharashtra: Sindhudurg District, Amboli, 28.9.1976, *P.G. Patwardhan & A.V. Prabhu*, *76.1233*: AMH.

Etymology: From the Latin *elevatus* (elevated) and *verrucosus* (warty): a reference to highly elevated verruceae.

Thallus crustose, corticolous, grayish-green to dull brownish-green, distinctly warty, robust, thick; hypothallus absent. Ascomata lirelline, concolorous with the thallus, straight to curved, terminally acute, mostly simple, rarely branched irregularly, 1–9 mm long and 0.1–0.2 mm broad, immersed in verrucae of the thallus, raised; exciple, convergent, non-striate, present at the base, apically carbonized, covered with the thalline margin up to the top; hymenium hyaline, not inspersed, 84–147 µm tall, KI–; asci 2–4-spored. Ascospores hyaline, muriform, ellipsoidal, oblong, 76–109 × 25–29 µm, I+ violet.

Chemistry— Constictic, stictic (major), and hypostictic (minor) acids present.

Additional specimens examined—**India**. **Maharashtra**: Sindhudurg District, Amboli, *P.G. Patwardhan & A.V. Prabhu*, 76.1258, 76.1259; *U.V. Makhija & A.V. Prabhu*, 76.1236: AMH

Remarks— *Graphis elevativerrucosa* is well characterized by the thick, highly elevated, conspicuous warts of the thallus, apically carbonized exciple without striae; 2–4-spored asci, muriform ascospores of 76–109 × 25–29 µm and by the presence of constictic, hypostictic and stictic acids in its thallus.

Graphis elevativerrucosa shares most of the morphological characters with *G. bilabiata* Nyl., a species from Ceylon, but the latter has extremely short, sessile lirellae with a thick lateral thalline margin.

Graphis streblocarpa (Bél.) Nyl., a species with immersed to emergent lirellae, large muriform ascospores, and a smooth to subtuberculate thallus, however, differs from the present species in prominently immersed ascomata in the thalline verrucae, 1–2-spored asci, and narrow (15–30 µm diam) ascospores.

The new species has been collected in semi-evergreen forest in open places on the roadsides.

Graphis galactoderma (Zahlbr.) Lücking, Lichenologist 41: 436 (2009). Fig. 1

specimens examined—**India**. **Maharashtra**: Kolhapur District, Panhala, *P.G. Patwardhan & A.V. Prabhu*, 74.1083, 74.1094, 74.1113, 74.1121; *P.G. Patwardhan & C.R. Kulkarni*, 74.1144: AMH

Thallus crustose, corticolous, epiphloeodal, uniform, continuous, pale yellow to white in colour, smooth to cracked, surrounded by thin, black hypothallus. Ascomata lirelline, up to 6 mm long and up to 0.2 mm broad, simple to branched or forked at apices, crowded, emergent to prominent, curved, wavy, flexuous, blackish, terminally acute or obtuse; lateral thalline margin not bulging, studded with crystals; exciple 1–4-striate, apically carbonized; hymenium hyaline, not inspersed, 84–100 µm tall, KI–; asci 8-spored. Ascospores hyaline, muriform, fusiform-oblong, 34–42 × 16–21 µm, I+ violet.

Chemistry—Constictic, stictic (major) and norstictic acid (minor) present.

Remarks— *Graphis galactoderma* has been collected at ca. 750 m from moist open forests that get heavy rains during the monsoon. This species, earlier known from the eastern palaeotropics, is a first report from India.

Graphis insulana (Müll. Arg.) Lücking & Sipman, Fieldiana Botany 46(1): 84 (2008). Fig. 2

≡ *Graphina insulana* Müll. Arg., Engler Bot. Jahr. 4: 56 (1883).

specimens examined—**INDIA**. **Maharashtra**: Ratnagiri District, Nerur, *A.V. Prabhu*, 75.486, 75.487; Dabhole ghat, *A.V. Prabhu & M. B. Nagarkar*, 74.2068: AMH

Thallus crustose, corticolous, whitish-gray to light greenish-gray, smooth, cracked with the age, delimited by a black hypothalloidal region at the periphery. Ascomata lirelline, mostly immersed, to rarely slightly emergent, straight to curved, terminally acute, mostly simple, rarely irregularly branched, up to 11 mm long and up to 0.25 mm broad; exciple convergent, non-striate, laterally to sometimes completely carbonized, present at the base; hymenium hyaline, inspersed, 134–168 µm tall, KI–; asci 1-spored. Ascospores hyaline, muriform, oblong, with more or less rounded ends, 67–118 × 17–29 µm, I–.

Chemistry —Norstictic acid present.

Remarks—*Graphis insulana,* a widely distributed species in the tropical regions of the world, was earlier described from Maharashtra as *Graphina nylanderi* Patw. & C.R. Kulk. (Patwardhan & Kulkarni1979). It has also been reported from Karnataka in India.

Graphis maharashtrana Chitale, Makhija & B.O. Sharma, **sp. nov.** Fig. 3

MycoBank MB 519287

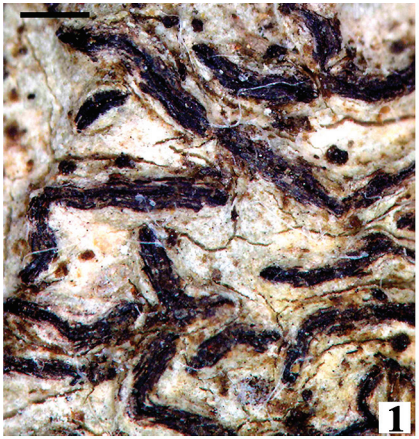
Similis Graphis panhalensis, *sed excipulo lateralis nigro, ascosporis minoribus, et acida consticticum*, *hyposalazinicum et sticticum continens differt.*

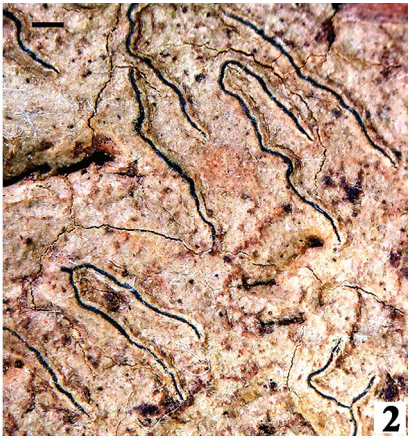
Holotypus—India. Maharashtra: Sindhudurg District, on the way to Ajra from Amboli, 10.10.2000, *U.V. Makhija & B.A. Adawadkar*, *00.168*: AMH.

Etymology: From the state name Maharashtra.

Thallus crustose, corticolous, endophloeodal, continuous, smooth to cracked, grayish-white to dirty white, surrounded by a thin black hypothallus. Ascomata lirelline, short, up to 3 mm long and 0.1 mm broad, simple to branched, immersed to semi-emergent, irregularly curved, flexuous, scattered, concolorous with the thallus to black, terminally round to acute; exciple 4–5-striate, laterally carbonized, present at the base, convergent, covered by a thick thalline margin up to the top; studded with crystals; hymenium hyaline, not inspersed, 34–46

Figure 1–6. Habit: 1. *Graphis galactoderma* (74.1121: AMH); 2. *G. insulana* (75.486:AMH); 3. *G. maharashtrana* (Holotype); 4. *G. panhalensis* (Holotype); 5. *G. parilis* (74.1826:AMH); 6. *G. platycarpa* (74.1826: AMH). Bar = 1 mm


1


2

3

4

5

6

μm tall, KI–; asci 8-spored. Ascospores hyaline, muriform, fusiform-oblong, without gelatinous sheath, 25–42 × 13–17 μm, I+ violet.

Chemistry—Constictic, stictic acids present.

Additional specimens examined—**INDIA**. **Maharashtra**: Kolhapur District, Panhala, *P.G. Patwardhan & A.V. Prabhu*, 74.1063b, 74.1076; 74.1078, 74.1091; *P.G. Patwardhan & C.R. Kulkarni*, 74.1095, 74.1101, 74.1129. Nasik District, Anjaneri, *B.C. Behera & G.S. Chitale*, 02.232; Saptashringi, *B.C. Behera & G.S. Chitale*, 02.185. Pune District, Bhimashankar, *B.A. Adawadkar*, 97.19; Lonavala, *B.C. Behera & B.A. Adawadkar*, 00.87; Khandala, *B.C. Behera & V.A. Mantri*, 00.88; Lonavala, Walvan Dam, *B.C. Behera*, 02.122, 02.123; Malshej Ghat, Neemgiri, *U.V. Makhija & A.V. Bhosale*, 02.14B; Purandar fort, *U.V. Makhija & A.V. Bhosale*, 02.55: AMH

Remarks— *Graphis maharashtrana* belongs in a small group (Group 16, Lücking et al. 2009) of taxa with striate, laterally carbonized exciples, clear hymenium, and muriform ascospores. All species but one within this group lack lichen secondary metabolites. The exception, *G. neoelongata* Lücking, differs from the new species in having stictic and norstictic acids and very long and radiately branched lirellae.

The species can easily be differentiated from the morphologically similar *G. panhalensis* in having a laterally carbonized exciple, smaller ascospores of 25–42 × 13–17 μm and constictic and stictic acids. *Graphis panhalensis* has apically carbonized exciple and larger ascospores of 45–65 × 12–16 μm; it contains has only stictic acid.

Graphis maharashtrana has been collected from the bark of *Mangifera indica* in the dry deciduous forests.

Graphis panhalensis (Patw. & C.R. Kulk.) Chitale, Makhija & B.O. Sharma, **comb. nov.** Fig. 4

MycoBank MB 519294

≡ *Graphina panhalensis* Patw. & C.R. Kulk., Norw. J. Bot. 26: 47 (1979).

Thallus pale glaucous green, smooth to indistinctly warty; ascomata emergent, black, simple, curved or flexuous, 0.5–2 mm long, ends subacute; exciple 4–5-striate, carbonized only at the apices; hymenium not inspersed; asci 8-spored; ascospores hyaline, muriform, ellipsoid, 45–65 × 12–16 μm.

Chemistry—Stictic acid present.

Specimen examined—**INDIA**. **Maharashtra**: Panhala, 13.10.1974, *P.G. Patwardhan & C.R. Kulkarni*, *74.1075*: AMH (**holotype**)

Remarks—*Graphis panhalensis,* established as *Graphina panhalensis* by Patwardhan & Kulkarni (1979) from Maharashtra, is now placed in *Graphis* in the new system of Staiger (2002) based on its convergent, well developed exciple with distinct carbonized areas and colourless ascospores. This species is known only from its type.

Graphis parilis Kremph., Flora 59: 422 (1876). Fig. 5

specimens examined—**INDIA**. **Maharashtra**: Satara District, Mahabaleshwar, Arther Seat, *M.B. Nagarkar & A.V. Prabhu*, 74.1765, 74.1769; Lodwick point, *M.B. Nagarkar & A.V. Prabhu*, 74.1826, 74.1839, 74.1849, 74.1910, 74.1911; *A.V. Prabhu & M.B. Nagarkar*, 74.1823, 74.1824, 74.1825, 74.1827, 74.1835, 74.1872, 74.1927, 74.2952; Kolhapur District, Panhala, 13.10.1974, *P.G. Patwardhan & A.V. Prabhu,* 74.1132; Pune District, Malshej ghat, *U.V. Makhija & A.V. Bhosale*, 02.17: AMH

Thallus crustose, corticolous, epiphloeodal, continuous, smooth to cracked, or warty, greenish-yellow, surrounded by a thin, black hypothallus. Ascomata lirelline, up to 10 mm long and 0.2–0.5 mm broad, branched, curved, totally immersed to semi-emergent, or emergent, flexuous, concolorous with the thallus, terminally acute; exciple yellowish-brown, present at the base, apically carbonized, and convergent, 3–8-striate, covered by a thick thalline margin up to the top, studded with crystals; hymenium hyaline, not inspersed, 84–126(–136) µm tall, KI–; asci 2–8-spored. Ascospores hyaline, muriform, oblong, 46–76 × 13–17 µm, I+ violet.

Chemistry—Stictic acid present.

Remarks—*Graphis parilis,* a species earlier reported from Brazil, Canada, Florida, and Mexico, is here reported from India for the first time.

Graphis platycarpa Eschw., Fl. Brasil. 1:74 (1833). Fig. 6

specimens examined—**INDIA**. **Maharashtra**: Satara District, Mahabaleshwar, Arther Seat, *M.B. Nagarkar & A.V. Prabhu* 74.1759, 74.1763; Lodwick Point, *M.B. Nagarkar & A.V. Prabhu*; *A.V. Prabhu & M.B. Nagarkar*, 74.1864, 74.1902, 74.1839, 74.1910, 74.1911: AMH

Thallus crustose, corticolous, greenish-gray, epiphloeodal, continuous, smooth to cracked, uneven, rough, surrounded by a thin, black hypothallus. Ascomata lirelline, 1–3.2 mm long and 0.1–0.25 mm broad, simple to rarely with short branches, semi-emergent, scattered, concolorous with the thallus, terminally acute; exciple present at the base, 1–5-striate, carbonized only at tips, converging at the apical portion, covered by a thick thalline margin up to the top, studded with crystals; hymenium hyaline, clear, 100–136 µm tall, KI–; hypothecium hyaline to yellowish, 16–20 µm thick; asci 8-spored. Ascospores hyaline, muriform, fusiform-oblong, without gelatinous sheath, 7–14-transverse septa, lumina lenticular, 59–71 × 13–17 µm, I+ violet.

Chemistry— No lichen substances present.

Remarks— *Graphis platycarpa* was found in semi-evergreen forest in shady places. The most similar species, *G. glaucorufa* Vain., differs from *G. platycarpa* by its 1-spored asci.

Graphis platycarpa was earlier known from Manipur, India, and is reported for the first time from Maharashtra.

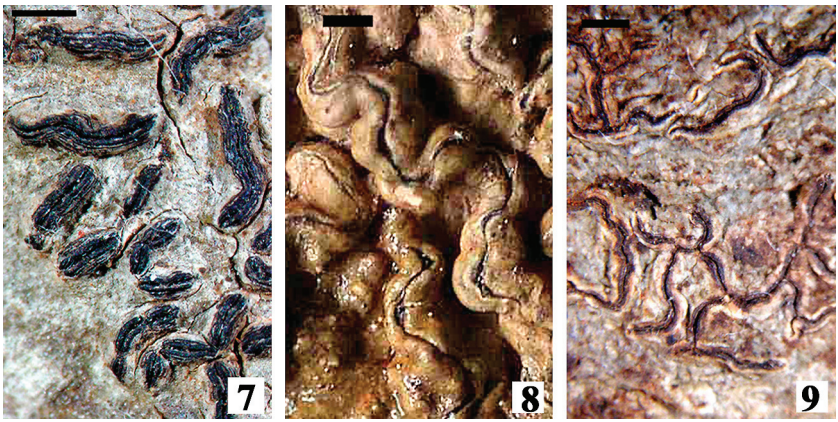


Figure 7–9. Habit. 7. *Graphis subducta* (04.89:AMH); 8. *G. elevativerrucosa* (Holotype); 9. *Graphis* sp. 1. Bar = 1 mm

Graphis subducta Vain., Ann. Acad. Sci. Fenn., ser. A, 15(6): 203 (1921). Fig. 7

specimens examined—**India**. **Maharashtra**: Kolhapur District, Panhala, *P.G. Patwardhan & A.V. Prabhu*, 74.1085, *G.S. Chitale*, 02.282. Ratnagiri District, Chiplun, *G.S. Chitale*, 04.89: AMH

Thallus crustose, corticolous, grayish, flaking, finely cracked, smooth to rough; hypothallus black. Ascomata lirelline, simple to rarely branched, triradiate, curved, emergent, up to 1.5 mm long, 0.2–0.5 mm broad; thalline margin raised, concolorous with the thallus; exciple convergent, 3–4-striate, apically carbonized; hymenium hyaline, not inspersed, 75–90 µm tall, KI+ blue-violet; asci 8-spored. Ascospores hyaline, muriform, small, ellipsoidal, 24–33 × 9–12 µm, I+ blue-violet.

Chemistry— Constictic and stictic acids present.

Remarks— *Graphis subducta,* a species previously known from the Philippines and in India from Nagaland, is here reported for the first time from Maharashtra.

***Graphis* sp. 1** Fig. 9

specimen examined—**India**. **Maharashtra**: Satara District, Mahabaleshwar, Lodwick point, *M.B. Nagarkar & A.V. Prabhu*, 74.1876, 74.1909: AMH

Thallus crustose, corticolous, epiphloeodal, continuous, smooth to cracked, uneven, slightly rough, greenish-yellow, surrounded by thin, black hypothallus. Ascomata lirelline, 1.5–7 mm long and 0.1–0.6 mm broad, simple to sparsely branched, semi-emergent, irregularly curved, flexuous, intricate, concolorous with the thallus, terminally acute; exciple 1–5-striate, yellowish-brown,

carbonized at apices, convergent, covered by a thick brown to blackish thalline margin up to the top, studded with crystals; hymenium hyaline, not inspersed, 126–176 µm tall, KI–; asci 8-spored. Ascospores hyaline, muriform, elliptical-oblong, 63–101 × 17–21 µm, I+ violet.

Chemistry —Stictic acid present.

Remarks—The present species is distinct in having unusual combination of large ascospores and chemistry. It is similar to *Graphis parilis* in respect of morphological characters and chemistry. However, *G. parilis* has much smaller ascospores of 46–76 × 13–17 µm. Since our material is rather scanty, we do not propose a new species.

Key to the species of *Graphis* from Maharashtra

1a. Ascospores trans-septate **2**
1b. Ascospores muriform **11**

2a. Proper exciple partially carbonized **3**
2b. Proper exciple completely carbonized including at the base **10**

3a. Proper exciple apically carbonized **4**
3b. Proper exciple laterally carbonized down to the base **5**

4a. Thallus verruculose; ascomata black, 0.5–4 mm long; exciple present below, 3–4 striate; ascospores 21–39 × 4–7 µm; stictic acid present . . ***G. vittata*** Müll. Arg.
4b. Ascomata concolorous with the thallus, 0.5–6 mm long, more or less effuse; exciple entire to 2–4 striate, indistinctly present at the base; ascospores 21–49 × 4–6 µm; constictic, connorstictic, and norstictic acids present ..... ***G. exalbata*** Nyl. (= *G. nerurensis* Makhija et al.)

5a. Exciple striate [Ascomata 0.1–7 mm long, black; exciple 2–13-striate, partially to completely carbonized; ascospores oblong, 12–24-trans-septate, with one end acute, 25–109 × 4–8 µm; no lichen substances present.] ..... ***G. polystriata*** Makhija et al.
5b. Exciple not striate **6**

6a. Norstictic acid absent [Ascomata 1–8 mm long, black; exciple present at base, ascospores 5–8-trans-septate, 20–38 × 5–8 µm; constictic and stictic acids present ..... ***G. modesta*** Zahlbr.
6b. Norstictic acid present **7**

7a. Ascospores less than 50 µm long **8**
7b. Ascospores more than 50 µm long **9**

8a. Thallus smooth to minutely warty; ascomata 1–4 mm long, black; exciple present at base; ascospores 9–11-trans-septate, (20–)30–40 × 6–8 µm; constictic, norstictic and stictic acids present ..... ***G. ajarekarii*** Patw. & C.R. Kulkarni
8b. Thallus smooth to plicate; ascomata 1–2.5 mm long, black; exciple present below; ascospores 3–10-trans-septate, 17–42 × 5–9 µm; constictic and norstictic acids ..... ***G. librata*** C. Knight

9a. Thallus brownish to greenish-grey; ascomata 0.5–6 mm long, concolorous with the thallus; exciple may or may not be present at the base; ascospores 8–16-trans-septate, 25–60 × 5–11 µm; norstictic acid present ..... ***G. pyrrhocheiloides*** (Vain.) Zahlbr.

9b. Thallus whitish; ascomata 1–8 mm long, black; exciple present at base; ascospores 8–11-trans-septate, 25–50 × 7–10 µm; norstictic and stictic acids present ..... ***G. cincta*** (Pers.) Aptroot (= *G. guimarana* Vain.)

10a. Thallus off white; ascomata 1–5 mm long, black; exciple present at base, multistriate; ascospores 6–9(–12)-trans-septate, 21–35 × 4–8 µm; no lichen substances present ..... ***G. duplicata*** Ach.

10b. Thallus olivaceous buff to citrine green; ascomata 0.5–3 mm long, black; exciple present at base, 3–4-striate; ascospores 7–10-trans-septate, 30–45 × 6–10 µm; no lichen substances present ..... ***G. aurita*** Eschw. (= *G. persulcata* Stirt.)

11a. Exciple laterally carbonized **12**

11b. Exciple apically carbonized **13**

12a. Ascomata immersed, to slightly emergent, 0.1–11 mm long; exciple sometimes completely carbonized, without striae; asci 1-spored; ascospores 67–118 × 17–29 µm; norstictic acid present ..... ***G. insulana***

12b. Ascomata grayish-white to dirty white to blackish, 0.1–3 mm long, immersed to semi-emergent; exciple 4–5-striate; ascospores 25–42 × 13–17 µm; constictic, stictic and hyposalazinic acids present ..... ***G. maharashtrana***

13a. Exciple not striate. [Ascomata emergent, 1–8 mm long; asci 2–4-spored; ascospores 76–109 × 25–29 µm; constictic, hypostictic (trace) and stictic acids present] ..... ***G. elevativerrucosa***

13b. Exciple striate **14**

14a. Ascospores less than 50 µm long **15**

14b. Ascospores more than 50 µm long **16**

15a. Ascomata up to 6 mm long. Thallus pale yellow to white; ascomata 1–6 mm long, simple to branched, semi-emergent to emergent; exciple, 1–4-striate; ascospores 34–42 × 16–21 µm; constictic, norstictic (trace) and stictic acids present ..... ***G. galactoderma***

15b. Ascomata simple to rarely branched, tri-radiate, curved, emergent, 1–1.5 mm long; exciple 3–4-striate; ascospores 24–33 × 9–12 µm; constictic and stictic acids present ..... ***G. subducta***

16a. Lichen substances absent. [Ascomata 1–3 mm long, simple, or rarely with short branches, semi-emergent; exciple 1–5 striate; ascospores 59–71 × 13–17 µm] ..... ***G. platycarpa***

16b. Lichen substances present **17**

17a. Ascospores up to 100 µm long. [Ascomata 1.5–7 mm long, simple to sparsely branched, semi-emergent; exciple 1–5-striate; ascospores 63–101 × 17–21 µm; stictic acid present] ..... ***Graphis* sp. 1**

17b. Ascospores less than 100 µm long **18**

18a. Ascomata concolorous with the thallus, 1–10 mm long, branched, totally immersed, semi-emergent, or emergent; exciple yellowish-brown, 3–8-striate; ascospores 46–76 × 13–17 µm; stictic acid present . . . . . ***G. parilis***

18b. Ascomata black, short, 0.5–2.0 mm long, emergent; exciple 4–5-striate; ascospores 45–65 × 12–16 µm; stictic acid present . . . . . ***G. panhalensis***

Acknowledgments

We are grateful to the Ministry of Environment and forests and the Department of Science and Technology, Government of India, New Delhi for the financial support. We also thank Miss Pradnya Khadilkar for preparing illustrations.

Literature cited

Adawadkar B, Makhija U. 2004. A new isidiate species of *Graphis* from India. Lichenologist 36: 361–363. doi:10.1017/S0024282904014409

Adawadkar B, Makhija U. 2006. New species and new records of *Graphis* from India: trans-septate species with completely carbonized exciples and norstictic acid. Mycotaxon 96: 51–60.

Adawadkar B, Makhija U. 2007. New species and new records of *Graphis* from India with partially carbonized exciples and trans-septate ascospores. Mycotaxon 99: 303–326.

Chitale G, Makhija U, Sharma BO. 2009. New combinations and new species in the lichen genera *Hemithecium* and *Pallidogramme*. Mycotaxon 108: 83–92. doi:10.5248/108.83

Culberson CF. 1972. Improved conditions and new data for the identification of lichen products by a standardized thin-layer chromatographic method. Journal of Chromatography 72: 113–125. doi:10.1016/0021-9673(72)80013-X

Culberson CF, Kristinsson H. 1970. A standardized method for the identification of lichen products. Journal of Chromatography 46: 85–93. doi:10.1016/S0021-9673(00)83967-9

Jagdeesh Ram TAM, Sinha GP, Singh KP. 2007. A new species of *Graphis* (*Graphidaceae*) from India. Lichenologist 39: 231–233. doi:10.1017/S0024282907006482

Lücking R. 2009. The taxonomy of the genus *Graphis* sensu Staiger (*Ascomycota*: *Ostropales*: *Graphidaceae*). Lichenologist 41: 319–362. doi:10.1017/S0024282909008524

Lücking R, Archer AW, Aptroot A. 2009. A world wide key to the genus *Graphis* (*Ostropales*: *Graphidaceae*). Lichenologist 41: 363–452. doi:10.1017/S0024282909008305

Makhija U, Adawadkar B. 2005a. Some additions to the *Graphidaceae* in the Andaman Islands, India. Mycotaxon 91: 347–352.

Makhija U, Adawadkar B. 2005b. Some new species of *Graphis* (Lichenized *Ascomycota*) from the Andaman and Nicobar Islands of India. Mycotaxon 91: 369–379.

Makhija U, Dube A, Adawadkar B, Chitale G. 2005a. Some species of lichen genera *Dyplolabia* and *Graphis* from Maharashtra. Geophytology 36(1–2): 61–68.

Makhija U, Dube A, Adawadkar B, Chitale G. 2005b. Five trans-septate species of *Hemithecium* from India. Mycotaxon 93: 365–372.

Makhija U, Chitale G, Sharma BO. 2009. New species and new records of *Diorygma* (*Graphidaceae*) from India: species with convergent exciples. Mycotaxon 109: 379–392. doi:10.5248/109.379

Patwardhan PG, Kulkarni CR. 1979. Some new taxa of the family *Graphidaceae* from western ghats, southwestern India. Norwegian Journal of Botany 26: 45–52.

Sharma BO, Makhija U. 2009. New species and new reports of *Diorygma* (lichenized *Ascomycotina, Graphidaceae)* from India. Mycotaxon 109: 209–217. doi:10.5248/109.209

Singh KP, Sinha GP, Bujarbarua P. 2004. Endemic lichens of India. Geophytology 33: 1–16.

Staiger B. 2002. Die Flechtenfamilie *Graphidaceae*: Studien in Richtung einer natürlicheren Gliederung. Bibliotheca Lichenologica 85: 1–526.

White FJ, James PW. 1985. A new guide to microchemical techniques for the identification of lichen substances. Bulletein British Lichen Society. 57(Suppl.): 1–41.